THE PTERIDOPHYTA OF TAIWAN-6 HYMENOPHYLLACEAE: HYMENOPHYLLUM(1)

CHARLES E. DEVOL(2)

In a previous issue of TAIWANIA I discussed the Trichomanes (sensu late) of Taiwan (DeVol, 1968;89–132). This paper is a continuation of the study of the Hymenophyllaceae. Copeland divided the genus Hymenophyllum into 9 subgenera (1937:14), and in 1938 he revised his work and raised his subgenera to genera, recognizing 14 genera. Three of his genera are represented on Taiwan: we have 2 and possibly 3 species of Hymenophyllum, at least 5 species of Meringium and 7 or more species of Mecodium. The differences between these subgenera are not great. They have much in common and do not show the marked differences that are noted in the subgenera of Trichomanes (sensu late). Hundreds of species of Hymenophyllum have been described and since our study primarily deals with the Taiwan species, it is evident that we are only working with a very small segment of this large genus and therefore some of our observations may not hold good for the entire genus.

Kawakami (1910:149) listed 4 species of Hymenophyllum from Formosa. He called his number **2108** *H. tunbridgense*, but I do not know what plant he referred to, Sasaki (1928:2–3) listed 10 species but I recognize only 6 of them as distinct species. He has 3 names for what we now call *H. polyanthos* and 3 names for what we call *H. badium*. His list begins with *H. acanthoides* Nakai and whether this is true *H. acanthoides* or *H. denticulatum* I am not sure. I have not seen any true *H. acanthoides* from Taiwan, all specimens so named in our herbarium are *H. denticulatum*. Masamune (1936:1–2) listed 11 species and in his 1954 mimeographed list, 17 species are enumerated (1954:4). Of the latter only 13 are what we consider distinct species, other names are synonyms, e.g. *H. Okadai* Masamune is *H. simonsianum* Hook.

I am recognizing 16 species from Taiwan but I have only seen 13 of these. Three are based on the collections and reports of others. I am describing one new species collected by T. Ito in 1914.

Hymenophyllum differs from Trichomanes in a number of ways:

The cleared leaves of many Trichomanes show one or more rows of brachysclereids in the veins and false veins. Our species of Hymenophyllum have no false veins, furthermore no specimen that we have examined shows these sclereids in the true veins.

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(2) 棣慕華 Professor of Botany, National Taiwan University.

Taiwan species of Hymenophyllum all have widely creeping glabrescent rhizomes which root at intervals. Some of the Trichomanes do not have creeping rhizomes; many of the Trichomanes which do have creeping rhizomes are entirely without roots and their rhizomes are covered with persistent dark brown multicellular hairs. The growing tips of the rhizomes and the base of the stipes of Hymenophyllum are usually covered with long yellowish-brown hairs, these are often one-celled hairs, some species have hairs of 2 or more cells. Older rhizomes have very few hairs.

Morton divided Hymenophyllum into five subgenera, and divided his first subgenus into five sections. (Morton 1968:162–163) The chief character that he used to distinguish **Section 1. Hymenophyllum** from the other sections was that in this section the sori are directed in a plane perpendicular to the plane of the lamina. I have not found this distinction to hold for our species. Both the living and pressed specimens of *H. barbatum* and *H. simonsianum*, that we have seen, show the sori directed in the same plane as the lamina. Fronds with sori bent perpendicular to the lamina are very pronounced in some of our Taiwan filmy ferns e.g. *Selenodesmium obscurum*, but this character has not been seen in any of our ferns belonging to **Section One** of the subgenus **Hymenophyllum.**

The other character that Morton uses to distinguish Section 1 from the other four sections is as to whether the sporangia are borne to the base of the receptacle. Of the four Taiwan species of Meringium which I have seen, only one would fit Morton's criteria, the other three species have the sporangia covering the base as in Section 1.

The most commonly used character to distinguish Meringium from Euhymenophyllum is its exserted receptacle, but young fronds may not have exserted receptacles, and old fronds may have their receptacles broken off.

The cell walls of Meringium are usually thicker than those of Hymenophyllum, but not always so. Both Euhymenophyllum and Meringium have the same type of small microscopic 2-celled clavate hairs along their veins. There apparently is no single character that can he used to separate all the species of what is called Hymenophyllum (sensu stricta) from Meringium.

In a preceding issue of Taiwania I gave a key to the Hymenophyllaceae (DeVol 1968:94–95) recognizing the three smaller genera: *Hymenophyllum*, *Meringium* and *Mecodium*. During the past months I have come to the opinion that the distinctions between these are not sufficient to warrant generic status, so am presenting a revised key. I regret that in the preceding key, the number placed before the genus name does not agree with the order in which I listed the genera in the paper.

Chromosome numbers have been given where they are known. We hope later to be able to give numbers for all species. In some instances the chromosome number has indicated that there is a difference between taxa which have often

been lumped together, e.g. *H. oligosorum* with a number of 2n=42 has at times been considered the same as *H. wrightii* with a 2n number of 84. And *H. wrightii* has been considered by some as only a small form of *H. polyanthos* which has a 2n number of 56. In reporting chromosome numbers in this issue we are only citing reports of others, we are not ready to report any numbers based on our own studies.

Nearly all of the Chinese names for the species are taken from W. C. Shieh's book "Ferns and Fern Allies of Taiwan" (Shieh 1969).

Most of the references listed in the preceding paper on Trichomanes are not repeated in the bibliography at the end of this paper. In citing references we have tried to chose only those which either had a description, figure, or pertinent data. We have not cited all references to enumerations.

I have not cited all specimens seen, but I have cited all localities or nearly all the localities from which we have seen collections.

The cleared leaves for this study were prepared by Misses Lee Yeat-Chat (李月閘), Lu Chiu-Yi (陸錦一) and Chu Yi (朱儀) all of our Botany Department.

The drawings were prepared by our artist, Mr. C. C. Chen. (陳建鐘) Each drawing is based on Taiwan material.

Appreciation is here expressed to the following for the opportunity of examining their herbaria:

Mr. Wang-chueng Shieh of Chung Hsing University, Taichung.

Mr. Jen-li Wang of the Taiwan Forestry Research Institute, Taipei.

Prof. Tang-shui Liu head of the Forestry Department of National Taiwan University.

A revised key to the genera of the Hymenophyllaceae of Taiwan

1. Fronds tufted or approximate, roots fibrous, indusia tubular, receptacle exserted 2
1. Fronds distant..... 6
2. Small epiphytes; fronds lanceolate, bipinnatifid; laminar cells transversely elongate.....5. *Abrodictyum*
2. Terrestrial ferns, laminar cells not transversely elongate..... 3
3. Fronds pinnate: pinnae margins dentate.....3. *Cephalomanes.*
3. Fronds bipinnatifid to 4-pinnatifid..... 4
4. Stipe and rachis without long multicellular hairs .....4. *Nesopteris*
4. Stipe and rachis bearing long multicellular hairs 5
5. Fronds 4-pinnatifid, finely dissected, with only one vein per ultimate segment.....2. *Callistopteris*
5. Fronds tripinnatifid, not finely cut to base, pinnules with forking veins .....1. *Selenodesmium*

6. Indusia tubular or conical, if mouth is 2–lipped, not cleft to base..... 7
6. Indusia 2–lipped, cleft to base or nearly so .....13 *Hymenophyllum*
7. Fronds with specialized marginal cells or with false veins (either occuring in a submarginal line, as false veins between true ones or as scattered short striae)..... 8
7. Fronds without specialized marginal cells or false veins.....11
8. Marginal cells differing from laminar cells..... 9
8. Without specialized marginal cells, but with false veins 10
9. Radial walls of marginal cells nearly perpendicular to the margin.....*Vandenboschia latifrons*
9. Radial walls of marginal cells very oblique .....7. *Crepidophyllum*
10. Fronds digitately or pinnately divided, with submarginal false veins or short striae.....6. *Crepidomanes*
10. Fronds simple, ovate, obovate, or orbicular (not digitately or pinnately divided); with false veins between the true veins..8. *Microgonium*
11. Fronds digitately and dichotomously lobed 12
11. Fronds pinnatifid to 4–pinnatifid.....13
12. Fronds fan-shaped, upper margin deeply cleft but not dissected to base; lamina less than 1 cm long; stipes about as long as blade; indusia tubular, mouth much enlarged.....9. *Gonocormus*
12. Fronds dissected to base; lamina 1.5 to 2 cm long; stipes much longer than blade; indusia with short cone-like tube, mouth deeply undulate or somewhat 2–lipped .....10. *Microtrichomanes*
13. Lamina covered with long brown hairs .....11. *Pleuromanes*
13. Lamina not covered with long hairs .....12. *Vandenboschia*

A key to the species of Hymenophyllum of Taiwan

1. Margins of lobes dentate..... 2
1. Margins of lobes entire or slightly wavy 9
2. Stipe wingless or barely winged at base of lamina 3
2. Stipe winged at least for the upper half; (wing often very narrow)..... 4
3. Rachis wingless.....4. *H. blandum*
3. Rachis winged .....7. *H. alishanense*
4. Receptacle included, indusia lips incised 5
4 Receptacle protruding, indusia lips entire or only slightly crenulate at apex 6
5. Pinnae approximate, pinnules from adjacent pinnae often overlapping; indusia rounded.....1. *H. barbatum*

5. Pinnae distant, pinnules from adjacent pinnae separate; indusia ovate, or obovate .....2. *H. simonsianum*
6. Indusia without spine-like teeth on the outside..... 7
6. Indusia bearing spine-like teeth at least near the base..... 8
7. Indusia lips entire .....6. *H. holochilum*
7. Indusia lips toothed .....8. *H. taiwanense*
8. Margins of pinnules dark brown to black, wings only moderately crisped, stipes winged nearly to base; lips of indusia without spines .....5. *H. denticulatum*
8. Margins of pinnules not dark; wings strongly crisped; stipes winged about half way to base; lips of indusia also bearing spines on their backs.....3. *H. acanthoides*
9. Stipe, rachis and underside of veins conspicuously hairy .....14. *M. oligosorum*
9. Fronds glabrous, or with microscopic hairs 10
10. Receptacle cylindrical.....11
10. Receptacle short, capitate 15
11. Wing of rachis and stipe flat 12
11. Wing of rachis and stipe crisped.....14
12. Stipe winged about half way to base; lips of indusia minutely toothed.....13. *H. productum*
12. Stipe wingless or very narrowly winged; lips of indusia entire or crenulate 13
13. Dwarf plants, 1.5 to 3 cm tall.....15. *H. wrightii*
13. Fronds (including stipes) 10 to 25 cm tall, very variable in shape .....16. *H. polyanthos*
14. Lips of indusia incised .....11. *M. fimbriatum*
14. Lips of indusia entire or slightly toothed .....12. *M. javanicum*
15. Wing of rachis strongly crisped.....10. *M. crispato-alatum*
15. Wing of rachis broad, flat or slightly wavy.....9. *M. badium*

13. **Hymenophyllum** J. Sm.

膜蕨屬 Mo Chüeh Shu

Key to the subgenera of Hymenophyllum

1. Margins toothed.....Subgenus 1. Hymenophyllum
1. Margins entire, receptacle included, cell walls thin .....Subgenus 2. Mecodium

Subgenus 1. Hymenophyllum Morton 1968:164.

Hymenophyllum subgenus *Euhymenophylium* Presl, 1843.

Small epiphytes with widely creeping glabrescent rhizomes; rooting at intervals, roots densely covered with linear hairs; fronds with toothed margins, indusia cleft to base or nearly so.

1. H. barbatum (v.d. B.) Baker 華東膜蕨 **Plate 1**

Hooker and Baker, 1868:68; Nakai, 1926:240; T. Ito, 1928:340; Copeland, 1937: 84–87, pl. 43 fig. 4; 1938:38; Ogata, 1931 (4) pl. 181; DeVol, 1945:46; H. Ito, 1944: pl. 465; Ohwi, 1957:26; Tagawa, 1958:96; 1963:43; 218; Ching, 1959:157.

Leptocioncium barbatum v.d. B.

v.d. Bosch 1863. Nederl. Kruid Arch 5:416; Masamune 1954:5.

Hymenophyllum japonicum Miquel

Miquel 1867:183; Matsumara 1904:310.

Rhizome widely creeping, sparsely hairy, becoming glabrescent, rooting at intervals; hairs on rhizome, linear, yellowish-brown, unicellular (Pl. 1. Fig. 2) stipes distant, 1 to 2 cm long, winged above; fronds ovate, about 1 to 2.5 cm long, by 1 to 1.5 cm broad, bipinnatifid; pinnae closely spaced, usually overlapping, margins toothed, segments obtuse; rachis winged, wavy or crisped; hairs on stipe, rachis and along veins or two types; long, linear, multicellular (Pl. 1. Fig. 5) and short, clavate 1 or 2 celled; (Pl. 1. Fig. 6) sori sunken at base of terminal pinnae, very hairy when young; indusia rounded, cleft to base, lips toothed at apex, sides usually entire; sporangia borne to base of receptacles.

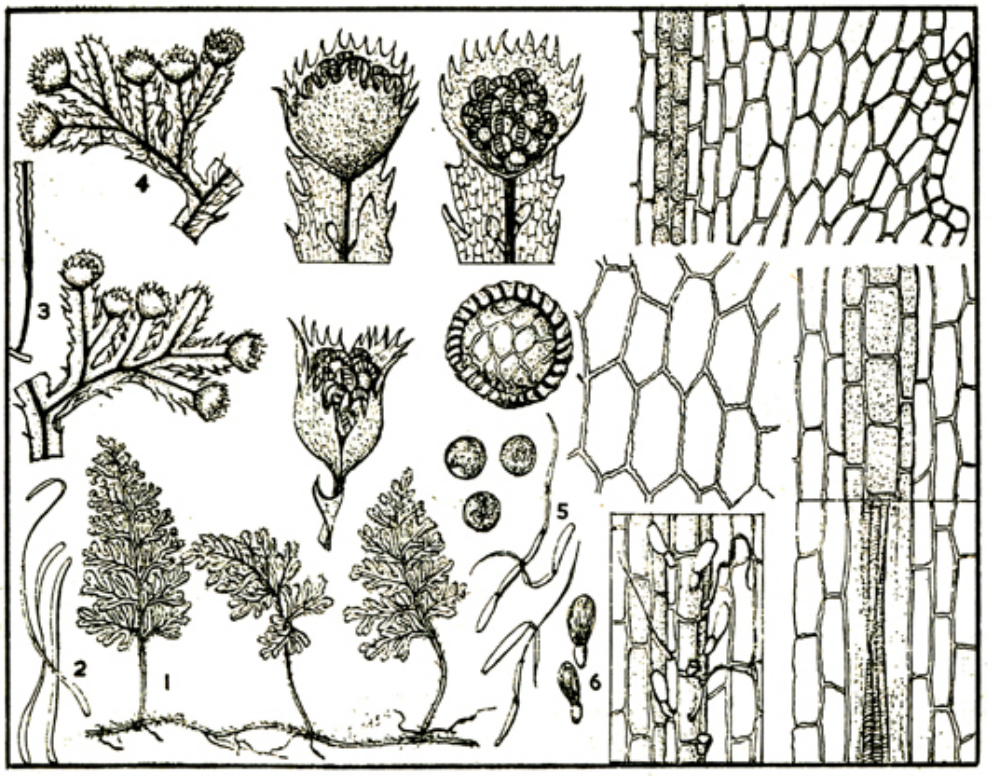

Plate 1. H. barbatum (v.d. B.) Baker. Hwalien Co: *Nakamura 4994.*

Cellular structure: Laminar cells polygonal, somewhat irregular in shape but usually about twice as long as broad; laminar cell walls thin, straight; marginal row of cells with cross-walls at right angles to the margin; veins with 2 to 3 or several rows of spiral tracheids in the center, surrounded by long sclerenchyma cells.

Chromosome number: Reported by Tatuno and Takei as 2n=42 (1969:12)

Distribution: Korea, Japan, Okinawa, Taiwan, Mainland China, India.

Taiwan:

Chiayi Co., Mt. Ali, *Hsu* and *Kuo 7451.*
Hwalien Co., Near Chi-lai, *T. Nakamura 4943, 4944.*
Taichung Co., Ta-hsueh-shan, *Chen 1379.*
Kaohsiung Co., Lao-lung, *Shieh 44*; Luh-kuei, *Chen 638.*

2. H. simonsianum Hooker 寬片蹊蕨 **Plate 2**

Hooker, 1860: pl. 13; Hooker and Baker 1868:68; Beddome, 1868: pl. 281; 1892: 34; Hayata 1915(5): 258–259 fig. 92; Nakai 1926, 241; T. Ito, 1928:389 pl.; Ogata, 1935(6): pl. 276; Copeland, 1937:88 pl. 44; H. Ito 1944 pl. 466; Ching, 1959:152 pl. 11 fig. 1–3.

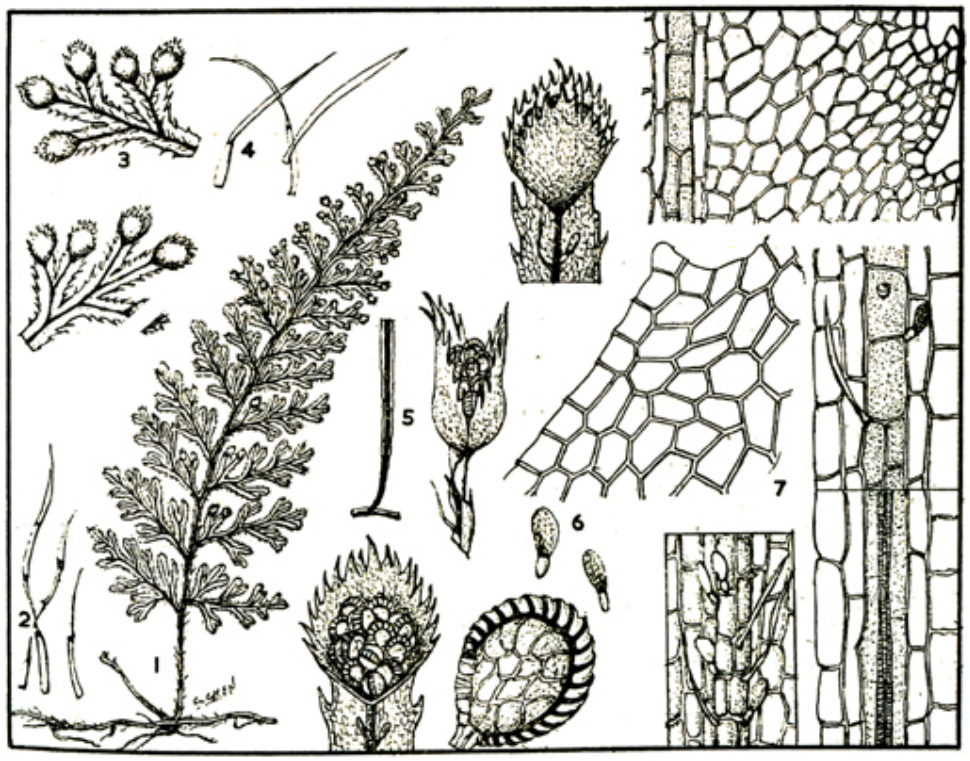

Plate 2. H. simonsianum Hooker. Ilan Co: Tapinshan, *T. Suzuki 513.*

H. Okadai Masamune

Masamune, 1935:14.

Rhizome filiform, rooting at intervals, widely creeping, sparsely covered with multicellular yellowish hairs (Pl. 2. Fig. 2.), becoming glabrescent; stipes distant, 10 to 25 mm long, narrowly winged above, also bearing multicellular yellowish hairs; fronds bipinnatifid, 5 to 9 cm long, 18 to 25 mm broad, somewhat variable in shape, usually lanceolate, but may be broadest in middle, or nearer to apex; lower pinnae sometimes shortened; rachis winged to base, margin of wing wavy or slightly crisped, not toothed; undersurface of frond bearing linear multicellular hairs (Pl. 2. Fig. 4.) and short clavate hairs (2. Fig. 6.) along rachis and veins; ultimate segments obtuse, toothed; sori sunken at base into lateral segments; indusia ovate, oval or obovate, cleft to base, lips toothed; receptacle included; sporangia crowded to base of receptacle.

Cellular structure: Laminar cells polygonal, almost isodiametric; cell walls very thin, straight; marginal cells with cross-walls at right angles to the margin; veins bordered with long, narrow cells containing 2 to 3 rows of spiral tracheids in the center of vein and surrounded by long sclerenchyma cells and pitted fibers. Along the veins are borne a few scattered 2-celled clavate hairs and many 2-3 celled long linear hairs. Both types of hairs have a short basal cell. The terminal cells of the hairs are rather easily broken off from the basal cell.

Distribution: Northern India, Sikkim, Mainland China (Yunnan), Taiwan.

Taiwan:

Taipei Co., Ruggyahu, *T. Suzuki 16739, 18416*; Wulai, *S. Suzuki* s.n. Nov. 9, 1928; *Kabosan T. Suzuki 12831*; Sendanyama, *T. Suzuki 7463*; Rimogan, *T. Suzuki 16505*; Tatunshan, *DeVol* and *Kao 9033*.

Ilan Co., Tapinshan, *S. Suzuki 513*; Da-Nanao, *T. Suzuki 18614*.

Taitung Co., Kusuhara, *T. Suzuki 19468*; Kiriyama, *Y. Okada* s.n. Type of *H. okadai* in N. T. U. Herb. from Taitung Co., Wushan (Kiriyama, Taito-tyo.) Leg. Y. Okada.

Chiayi Co., Alishan, *B. Hayata 82*; Mt. Morrison, *Kawakami 84*.

Nantou Co., Kuailin, *Shieh 584*.

Hualien Co., Taroko-taisan, *S. Sasaki* s.n. V. 27. 1933; Neng-kao-yueh, *Shieh 1022*. Mukuashan *T. Suzuki 4371*.

Hsinshu Co., Chu-tong, *T. Suzuki 20168*;

3. H. acanthoides (v.d. B.) Rosenstock 鐮翅厚壁蕨

Rosenstock, 1911:25; Rosenburg, 1916:100; Nakai, 1926:242; Copeland, 1937:45 pl. 17; Holttum, 1954:80 fig. 20.

Meringium acanthoides (v.d. B.) Copel.

Copeland 1938:42; 1958:63; Masamune, 1954:4; Ching, 1959:151.

Didymoglossum acanthoides v.d. B.

van den Bosch 1856:16.

Leptocionium acanthoides v.d. B.

van den Bosch 1861:42 pl. 32.

Fronds tripinnatifid about 5 cm tall, stipe winged at least half way down, often nearly to base; wing of stipe and rachis and margins of segments very strongly crisped; marginal teeth irregular and prominent (margins not black as in *H. denticulatum*); indusia cleft more than half way to base, densely covered with spine-like teeth on their backs from base to lips; receptacle cylindrical, exserted when old; cell walls thickened, wavy.

Distribution: Sumatra, Java, Borneo, New Guinea, Malaya, Philippines.

Reported from Taiwan.

Note: No specimens seen. Reported from Taipei Co., Rahao, collected by K. Miyabe s.n.

4. H. blandum Raciborski, Pterid. Buit. 1898:20. 爪哇厚壁蕨 **Plate 3**

Copeland, 1937:50 pl. 18; 1958:63; Holttum, 1954:77 fig. 18.

Meringium blandum (Racib.) Copel.

Copeland 1938:43; Masamune, 1954:4.

Rhizome filiform, glabrescent, rooting at intervals; hairs on rhizome, stipe and rachis sparse, long, yellow, multicellular (Pl. 3. Fig. 2.); hairs on roots plentiful; fronds (including stipe) up to 4 cm tall, pinnae simple or once forked, segments linear, margins toothed; stipe filiform, longer than blade; rachis terete, wingless

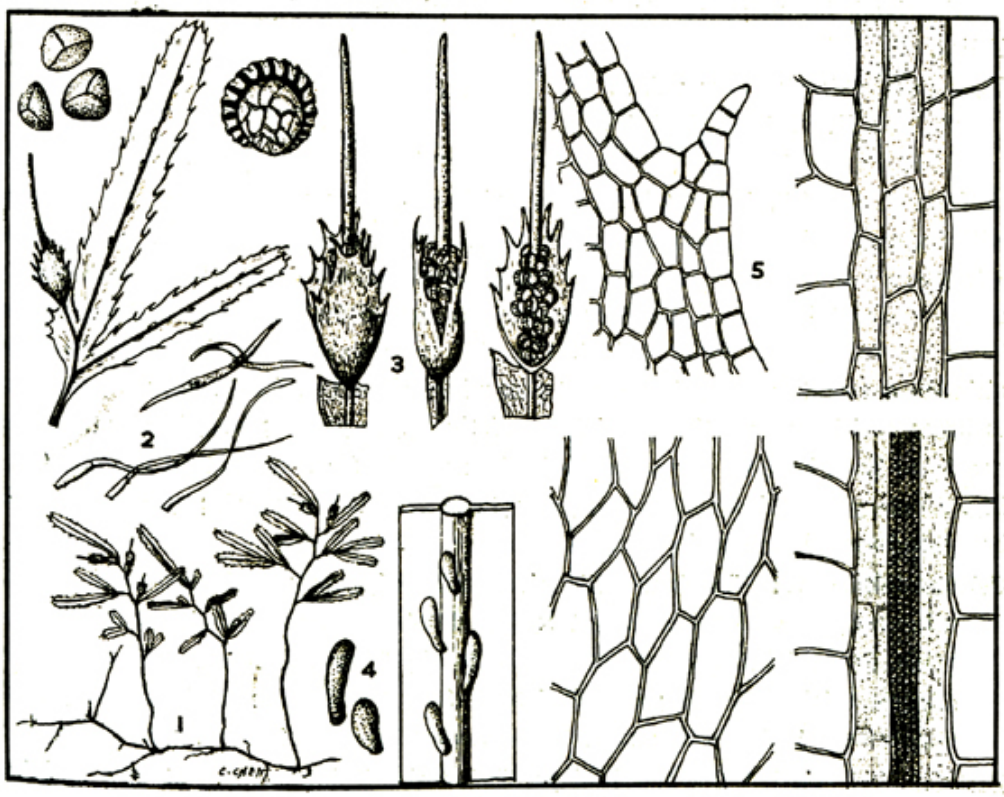

Plate 3. **H. blandum** Racib. Taipei Co: Mokkazan, *T. Suzuki 19380.*

except at base of uppermost pinnae; sori borne near base of upper pinnae, almost stipitate, lower part of indusia tubular, upper 1/2 or 2/3 cleft, upper margin of indusia toothed, receptacle cylindrical, exserted; sporangia sessile, borne to base of receptacle.

Cellular structure: Laminar cells rectangular, polyhedral or oblong, usually being a little longer than wide; cell walls straight or slightly wavy and only slightly thickened; marginal teeth about 3 cells wide at base; veins composed of rows of spiral tracheids surrounded by long cells some of which have thickened walls; a few short clavate or oblong cells are borne at intervals on the veins. (Pl. 3. Fig. 4.)

Distribution: Java, Sumatra, Borneo, Malaya, Philippines, Taiwan.

Taiwan:

Taipei Co., Mokkozan, *T. Suzuki 19380.*
Pingtung Co., Mutan, *Simozawa* s.n. Jan. 3, 1938.
Orchid Island, *T. Hosokawa 9837.*

5. H. denticulatum Swartz Schrad. Journ. 1801:100 厚壁蕨 **Plate 4**

Copeland, 1937:41 pl. 15; Holttum, 1954:79.

Meringium denticulatum (Sw.) Copel.

Copeland, 1938:42; 1958:62; H. Ito, 1944 pl. 468; Ching, 1959:150; Masamune, 1954:4.

Leptocionium denticulatum v.d. B.

van den Bosch 1861:39 pl. 29.

Rhizome widely creeping, sparsely covered with long, yellowish-brown, multicellular hairs, (Pl. 4. Fig. 2.) becoming glabrescent, the growing tip densely covered with hairs; rooting at intervals, roots covered with the same type of hairs; fronds 5 to 10 cm tall, ovate to lanceolate, tripinnatifid, rachis winged to base; lobes and wings moderately crisped, toothed; bearing scattered multicellular, yellowish-brown hairs on rachis and veins (Pl. 4. Fig. 4.); marginal cells dark brown to black, ultimate segments usually less than 1 mm wide; stipe 1 to 2 cm long, winged nearly to base; sori borne on the basal lobes of the upper pinnae; indusia elliptical, cleft nearly to base, bearing spines on its backs near the base but not on its lips, (Pl. 4. Fig. 7.) margins entire, apex obtuse, receptacle exserted when old; sporangia sessile, borne to base of receptacle.

Cellular structure: Laminar cells elongated, polygonal; walls straight, slightly thickened, appearing beaded (at ×440) (Pl. 4. Fig. 6.); veins with central strands of spirally thickened tracheids surrounded by long cells, some of which have slightly thickened walls; marginal teeth 3 or 4 cells wide at base. Copeland's plate 15 fig. 3 shows the walls to be wavy (Copeland, 1937 pl. 15).

Distribution: Ceylon, Burma, Malaya, Indonesia, Philippines, Vietnam, Mainland China (Kwangsi) Hainan, Taiwan, Okinawa, Fiji.

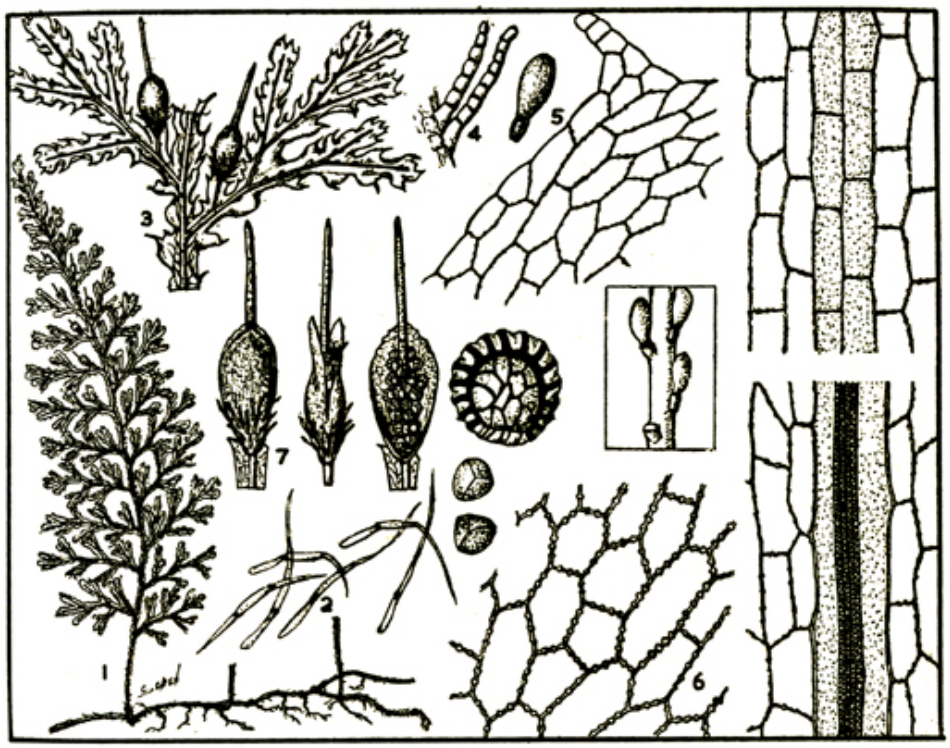

Plate 4. H. denticulatum Sw. Taipei Co: Ruggyahu, *T. Suzuki 21359.*

Taiwan:

Taipei Co., Kankou, *S. Sasaki* s.n. Nov. 10, 1932; Ruggyahu, *T. Suzuki 15842, 21359.*

6. H. holochilum (v.d. B.) C. Chr. 南洋厚壁蕨 **Plate 5**

Copeland, 1937:34 pl. 14; Holttum, 1954:77 fig. 17.

Meringium holochilum (v.d. B.) Copel.

Copeland, 1938:41; 1958:62; H. Ito, 1944 pl. 467; Ching, 1959:149; Masamune, 1954:4.

Didymoglossum holochilum v.d. B.

van den Bosch 1856:261

Rhizome filiform, widely creeping, rooting at intervals, becoming glabrescent; hairs on roots, rhizome, stipe, rachis and veins yellowish-brown, multicellular (Fig. 2.); hairs plentiful on tip of rhizome, young stipes and on the circinate buds; fronds usually 6 to 8 cm tall, lanceolate, bipinnatifid, pinnae once or twice forked, not cleft to base; stipes terete, 15 to 25 mm long; rachis very narrowly winged; wing flat, not toothed; margin of pinnae toothed; rachis and veins sparsely covered with persistent hairs on underside of frond; sori usually borne on the upper pinnae; indusia elliptical to oval cut nearly to base, margins entire or nearly so; receptacle

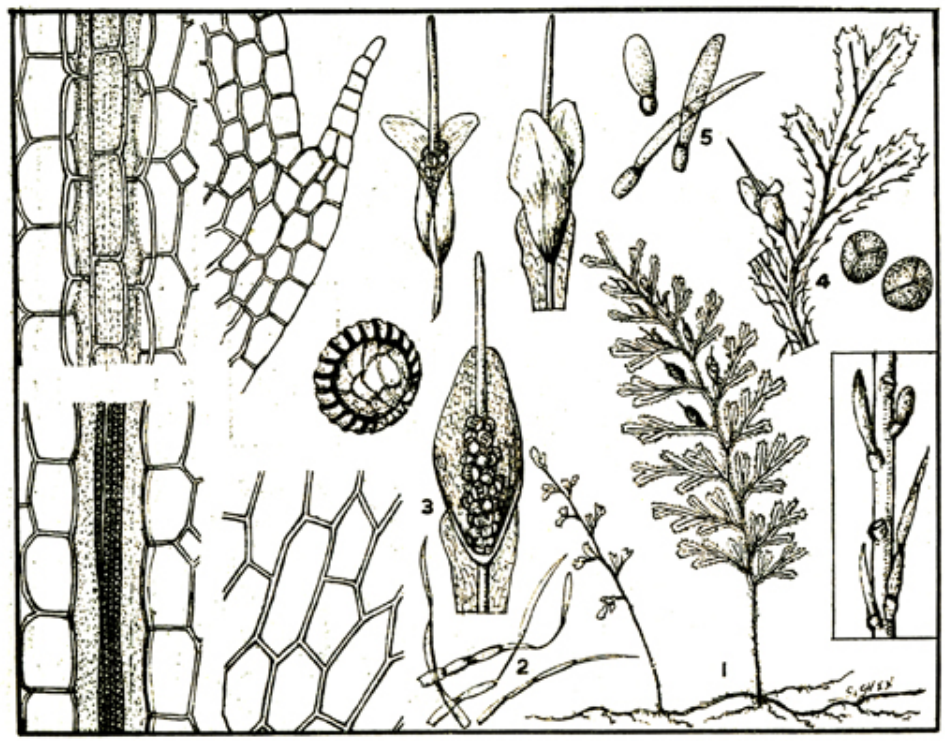

Plate 5. H. holochilum (v.d. B.) C. Chr. Taipei Co: Shan Chia, *S. Suzuki 5924.*

exserted on old fronds (Fig. 3.); sporangia sessile, borne to base of receptacle.

Cellular structure: Laminar cells elongated, polyhedral; walls straight, or somewhat wavy, only slightly thickened; cells near the margin have thicker walls than those nearer the center of the leaf; veins with about 3 strands of spiral tracheids surrounded by long cells, some of which have thickened walls; multicellular linear hairs borne along sides of veins; marginal teeth long, narrow, about 3 cells wide at base.

Distribution: Sumatra, Java, Borneo, Malaya, Philippines, Taiwan.

Taiwan:

Taipei Co., Shan Chia, *S. Suzuki 5924*; Wulai, *Simozawa 825*; Rimogan, *T. Suzuki 14187*; Tonkuhu, *T. Suzuki 16006*; Ruggyahu, *T. Suzuki 16824*; Mauto, *T. Suzuki 19405.*
Nantou Co., Kwai-lin, *Shieh 608.*
Hwalien Co., Mu-kua-shan, *T. Nakamura 4376.*
Taitung Co., Hsinkan, *T. Suzuki 19455, 19567.*

Note: Specimens in our herbarium from Kusaie, Micronesia are considerably larger than those we have from Taiwan or the Philippines. Some from Kusaie are 13 or 14 cm tall.

7. H. alishanense DeVol, sp. nov. 阿里山厚壁蕨 **Plate 6**

Rhizoma setaceum horizontale ramosum glabrescens, parce tectum cum pilis, linear, flavo-fusco in coloribus; stipes 0.5–1.0 cm longus, teretibus, glabris; frons oblongo-ovata, bipinnatifida, 4–6 cm longa, 1.5–2 cm lata; pinnae furcatae, lobis linearibus circa 2 mm latis, margine dentatis; rhachis deorsum anguste alata, margine planis et dentatis; sori in apice frondis; indusia lanceolata, bipartite, lobis dentibus, elongatis, acutis; receptacule filiformi, elongato, incluso; sporangiis pedicellatis.

Type: The type is deposited in the Herbarium of NTU, Sheet No. 119255. It is based on T. Ito's collection No. 025 from Mt. Ali. made in April 1914.

Rhizome filiform, widely creeping, becoming glabrescent, rooting at intervals; hairs on rhizome, roots, and base of stipe long, yellowish-brown, multicellular (Fig. 2.); fronds about 15 mm apart, 4 to 6 cm tall (including stipe), bipinnatifid, oblong, ovate or obovate (Fig. 1.); pinnae forked, lobes linear, about 2 mm broad; stipe terete, with narrow wing at base of lamina; rachis winged to base, wing flat, 1 mm broad; margin of lobes and rachis wing with long prominent, projecting teeth (Fig. 4.); sori abundant, borne on tips of terminal and upper pinnae; indusia lanceolate, somewhat constricted at base, scarcely emersed in leaf tissue, cleft to base, lateral

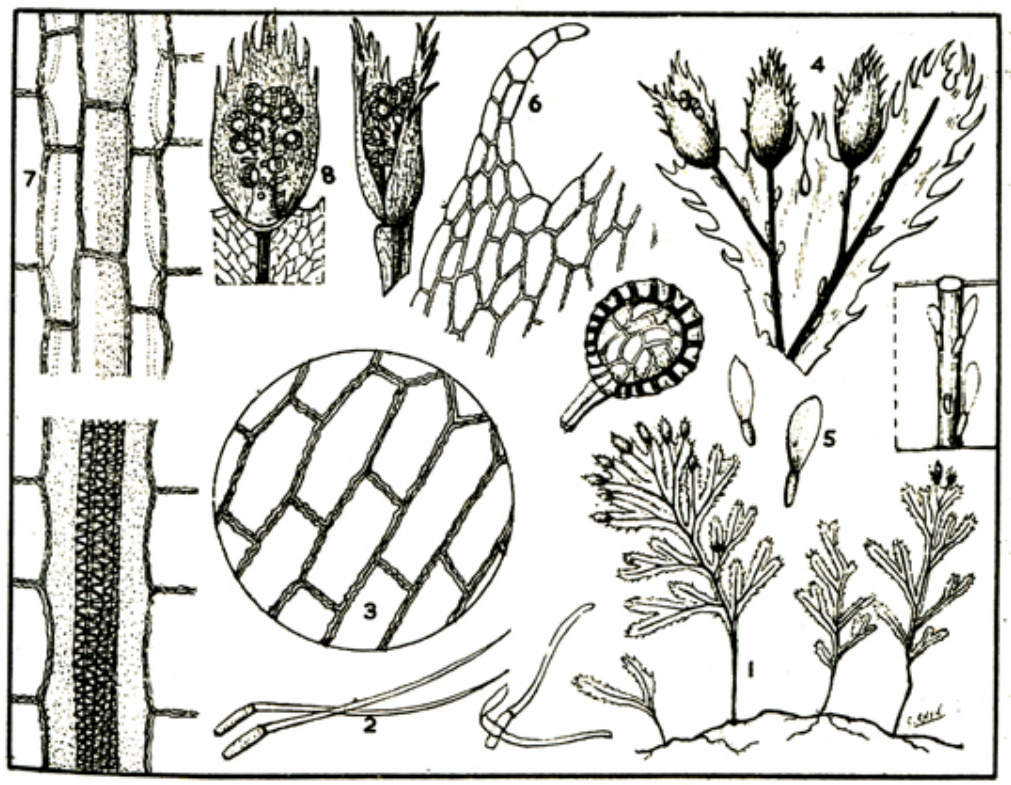

Plate 6. H. alishanense DeVol Chiayi Co: Mt. Ali, *T. Ito 025.*

margins almost entire, lips strongly toothed, receptacle included; sporangia stalked, not borne on base of receptacle (Fig. 8.)

Cellular structure: Laminar cells oblong, about twice as long as wide, walls thickened and wavy (as seen under ×440); marginal teeth 3 or 4 cells wide at base; veins contain rows of spiral tracheids surrounded by long cells some of which have thickened walls; the outer row of cells bordering the veins bear a few clavate 1 or 2 celled hairs (Fig. 5); cell walls (in uncleared specimens) appear thick, clathrate.

Taiwan:

Chiayi Co., Mt. Ali, *T. Ito 025.*

8. H. taiwanense (Tagawa) Morton 臺灣厚壁蕨

Morton, 1968:167.

Mecodium taiwanense Tagawa

Tagawa, 1940:141.

Rhizome widely creeping becoming glabrescent; stipe winged nearly to base, wing strongly crisped; fronds ovate to oblong, tripinnatifid, glabrous; rachis wing strongly crisped; margins minutely serrulate; indusia ovate, cleft nearly to base, upper margin of lips toothed, receptacle cylindrical.

Distribution: Taiwan

Taiwan:

Taitung Co., near Kakago, *Tagdwa 3144.* Type in Herbarium of Kyoto Imperial University.

Note: We have no specimen of this species in our herbarium. Tagawa says in form it is somewhat like *H. thuidium* of the Philippines.

Subgenus 2. Mecodium Copel. (Presl ex Copel.) 1937:93; Tindale, 1963:21; Morton, 1968:171.

Mecodium Presl

Presl, 1851:258; Copeland, 1938:17; Ching 1959:134.

蕗蕨屬 Lu Chueh Shu

Small epiphytes with slender creeping glabrescent rhizomes; fronds pinnately compound with entire margins, cell walls usually thin; indusia 2-lipped cleft to base or nearly so; receptacle included.

9. H. badium Hook. et Grev. 蕗蕨 **Plate 7**

Hooker et Greville, 1831: pl. 76; Copeland, 1937:144 pl. 76; Rosenburg, 1908:70.

Mecodium badium (Hook. et Grev.) Copel.

Copeland, 1938:23; H. Ito, 1944 pl. 462; 1949:123; Ohwi, 1957:25; 1965:34; Iwatsuki 1958:67; Tagawa, 1963:231.

H. flexile Makino

Makino, 1899:45; Nakai, 1926:245; Ogata, 1928, **1:** pl. 30; T. Ito, 1928: pl. 386; Copeland, 1937:150 pl. 80; H. Ito, 1944 pl. 461; Ohwi, 1965:34.

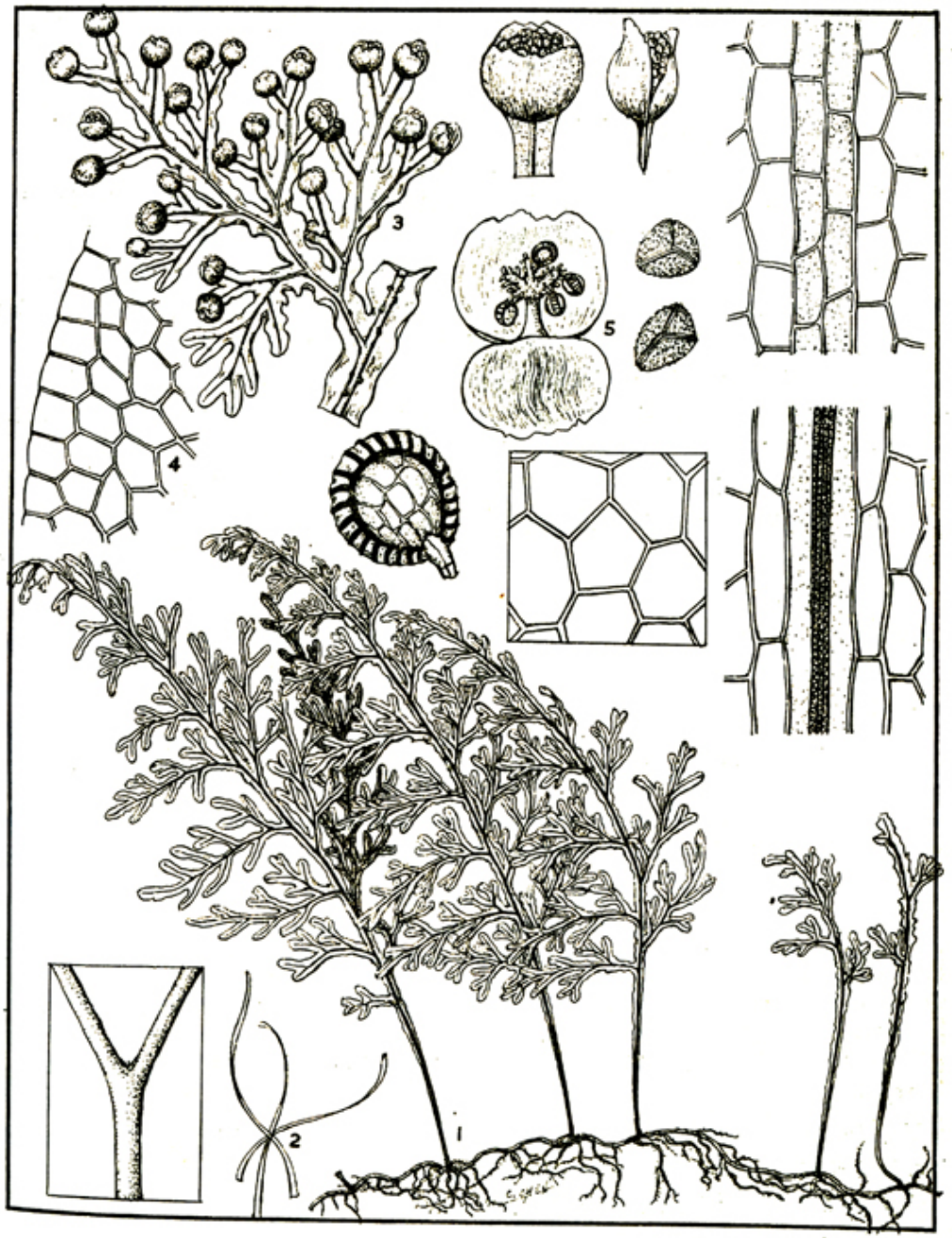

Plate 7. H. badium Hook. et Grev. Taipei Co: Tun Shan, *K.S. Hsu 23.*

H. junghuhnii sensu Ogata, 1935, 6 pl. 275.

H. omalopterum Hay.

Hayata in Sched. Herb. Imp. Univ. Tokyo. Type from Taipei Co., Rimogan, *E. Matuda* s.n. VII. 28. 1918. N. T. U. Herb.

H. retusilobum Hay.

Hayata, 1921, **10:** 72; Nakai, 1926:246; Sasaki, 1928:3; Type from Taipei Co., Uraisha, *Y. Shimada* et *T. Ito* April 1915. Isotype at TAIF.

Rhizome long creeping, nearly glabrous, rooting at intervals; roots bearing many brown hairs (Fig. 2.); stipes 1 to 2 cm apart, 3 to 5 cm long, winged almost to base; wings on stipe and rachis about 2 mm broad, flat, entire, or sometimes slightly crisped; fronds 12 to 30 cm tall, lanceolate, 3 to 4 pinnatifid, glabrous, with microscopic clavate hairs along veins, ultimate segments 1 to 2 mm wide, short, forking, apex obtuse; sori terminal on segments of lateral pinnae (Fig. 3.); indusia rounded, cleft to base, margin entire or crenulate; receptacle included, broad, capitate, forking; sporangia short stalked; not borne on base of receptacle (Fig. 5.).

Cellular structure: Laminar cells polyhedral, nearly isodiametric; cell walls thin, straight; veins with spiral tracheids surrounded by thick walled fibers and thin walled pitted cells; marginal cells with radial and inner tangential walls thickened, but outer tangential walls very thin (Fig. 4).

Distribution: Malaya, Vietnam, Philippines, Mainland China (Fukien, Kwangtung, Kwangsi, Kweichow, Yunnan), Taiwan, Japan.

Taiwan:

Taipei Co., Ta-tung-shan, *K. S. Hsu 23*; Kankou, DeVol 8133; Ta-tuen-shan *Shimada 94*; Sendan-yama, *T. Suzuki 7428*; Kweishan, *Simozawa 21*; Agyoku *Simizu 2749*; Rimogan, *Matudo*) VII. 28, 1918.

Hsinchu Co., Sotenyan, *T. Suzuki 4585*; Cha-li-tsien-shan, *Sasaki 77*.

Taichung Co., Pa-hsien-shan, *S. Suzuki* s.n. X-22. 1929.

Chiayi Co., Alishan, *T. Suzuki 17977*.

Nantou Co., Chitou, *Kao 7514, 6770*; *Chen 401*.

Ilan Co., Tai-ping-shan *S. Sasaki* s.n. V-17-1932; Chilanshan, *J. M. Chao* s.n. V1. 1-1966; Nan-ao, *T. Suzuki 18611*; Hsi-mao-shan, *Nakamura 4671*; Ta-yen-shan, *Kao 3205*; Bonbon, *Kao 5917*; Tien-shan-hu, *T. Ito 59*; Ho-she, *C. C. Kuo 826*.

Hualien Co., Fong Shan, *Liu 147*; Lin-tien-shan, *Feung 1*; Taroko *S. Sasaki* s.n. V1. 12. 1933; Mukuashan *Nakamura 4374*.

Taitung Co., Hsin-shui-yin, *T. Suzuki 7971*; Hsin-kan, *T. Suzuki 19439*.

10. H. crispato-alatum Hayata **Plate 8**

Hayata, 1915, 5:256–257; T. Ito, 1928 pl. 387; Copeland, 1937:149 pl. 79.

Mecodium crispato-alatum (Hayata) Copel.

Copeland, 1938:23; H. Ito, 1944 pl. 463.

H. javanicum sensu Hayata

Hayata, 1914, **4:** 141 fig. 81; Nakai, 1926:244.

Rhizome creeping, becoming glabrescent, rooting at intervals; stipes up to 5 cm long, winged nearly to base, wing strongly crisped; fronds lanceolate, tripinnatifid,

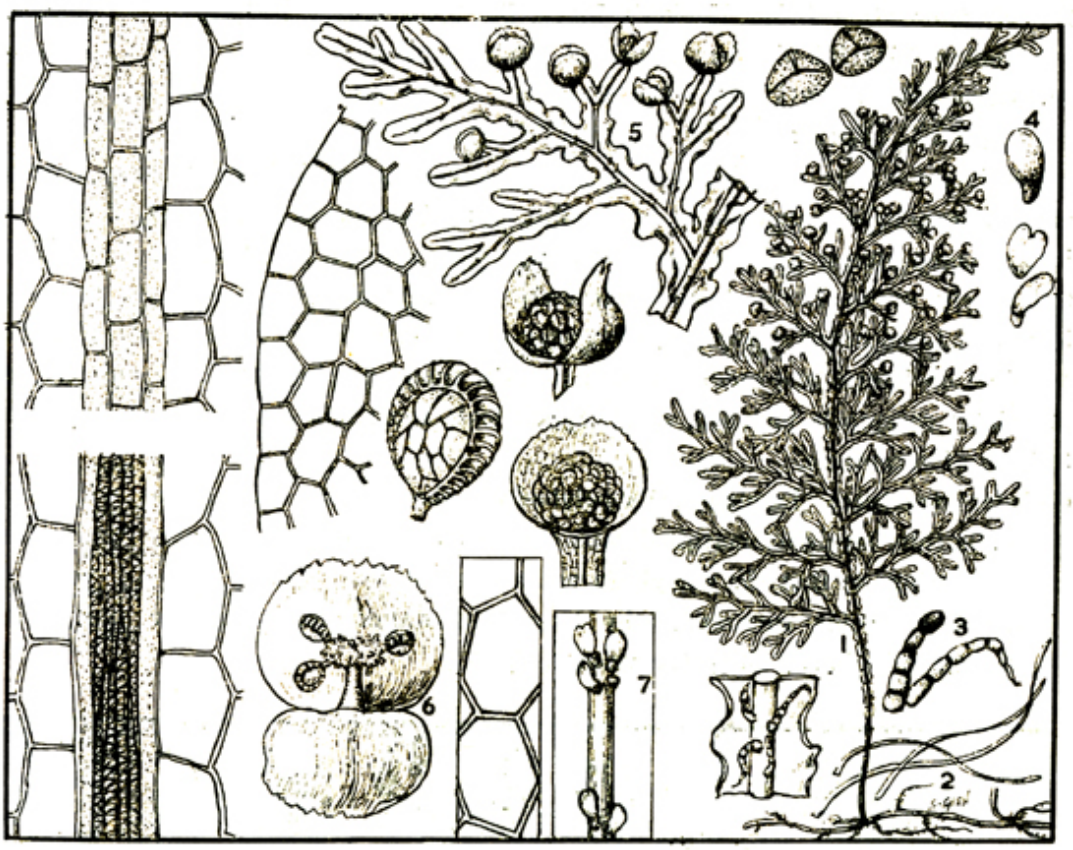

Plate 8. H. crispato-alatum Hay. Taichung Co: Pa-hsien-shan, *S. Suzuki* s.n. X. 23. 1929.

8–12 cm tall (including stipe); rachis winged, wing strongly crisped; ultimate segments linear, obtuse at apex, margins entire or wavy, becoming crisped on basal pinnae; sori plentiful along lateral pinnae; indusia cleft to base, broadly ovate or rounded, much constricted at base, lips entire to crenulate; receptacle short, included, capitate, branching; sporangia very short stalked, not borne to base of receptacle.

Cellular structure: Laminar cells polyhedral, nearly isodiametric; cell walls straight, thin; veins with spiral tracheids in center surrounded by elongated sclerenchyma cells; microscopic hairs along veins of two types: short clavate hairs and multicellular glandular hairs which taper to a point (Figs. 3, 4.) clavate hairs borne in clusters at intervals (Fig. 7.).

Taiwan:

Taichung Co., Pa-hsien-shan, *S. Suzuki* s.n. X. 23. 1929.
Chiayi Co., Alishan, *B. Hayata* s.n. IV. 2. 1908. *S. Sasaki* s.n. I-25-1906; *B. Hayata* et *T. Ito* III. 7. 1914.

Note: This species differs from *M. javanicum* in having rounded sori and capitate receptacles. It differs from *M. badium* in being much smaller, and having the stipe and rachis strongly crisped.

11. H. fimbriatum J. Sm. Hooker's Journ. Bot 3:418 (1841) 叢葉蕗蕨 **Plate 9**

Hooker, 1844:102 pl. 36–c; Copeland, 1937:122 pl. 60.

Mecodium fimbriatum (J. Sm.) Copel.

Copeland, 1938:21; 1958:52; Tagawa, 1940:141.

Rhizome widely creeping, nearly glabrous, rooting at intervals; roots bearing many linear, brown, unicellular hairs (Fig. 2.); stipes about 2 cm apart, 2 to 4 cm long, winged almost to base; wings on stipe and rachis crisped; fronds 7 to 10 cm tall, rarely up to 12 cm, lamina narrowly ovate, tripinnatifid; ultimate segments less than 1 mm broad, margins wavy, apex obtuse or minutely toothed; sori plentiful, terminal on lateral and apical pinnae; indusia rounded, cleft to base, oblong, lips fimbriate; receptacle included, short, cylindrical; sporangia crowded, sessile, borne to base of receptacle.

Cellular structure: Laminar cells polyhedral, about twice as long as wide; cell walls thin, straight; marginal cells somewhat irregular, their outer walls often protruding, so that the margin is not a straight line; (Pl. 9 Fig. 4.) veins of spiral tracheids surrounded by long thick-walled fibers; minute, unicellular, clavate cells borne along the veins. (Fig. 5.)

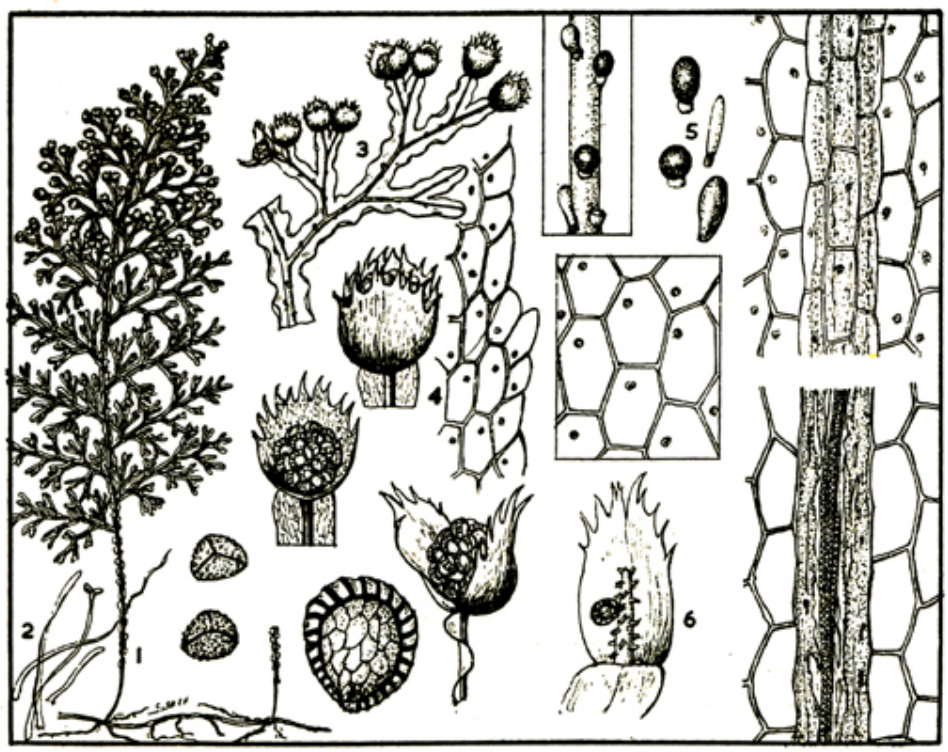

Plate 9. H. fimbriatum J. Sm. Taipei Co: Hatun, *T. Syzuki 14409.*

Distribution: Philippines, Taiwan.

Taiwan:

Taipei Co., Kuaishan, *T. Suzuki 18202*; Habun, *Nakamura 514*; *T. Suzuki 14409*. Sendan-yama, *T. Suzuki 7451*; Rimogan, *T. Suzuki 16913*; Agyoku, *T. Suzuki 14930*.
Hualien Co., Mu-kua-shan, *Nakamura 4370*; Hsin-shui-shan, *Nakamura 3570*.
Taitung Co., Chang-yen, *T. Suzuki 19454*; Wushan, *Hosakawa 5351*.

Note: Nakai (1926:245) reduced this species to a synonym of *H. crispatum* which has indusia with entire margins, but the lips of this species are fimbriate.

12. H. javanicum Sprengel 爪哇蕗蕨 **Plate 10**

Sprengel, 1827:122; van den Bosch, 1861:50 pl. 40; Copeland, 1937:120 pl. 59; Holttum, 1954:83; Hooker, 1844:1:106.

H. micranthum v.d. B.

van den Bosch, 1861:52 pl. 41.

H. australe non Willd.

Rosenburgh, 1908:69.

Mecodium javanicum (Spr.) Copel.

Copeland, 1938:20; Shieh, 1969:101.

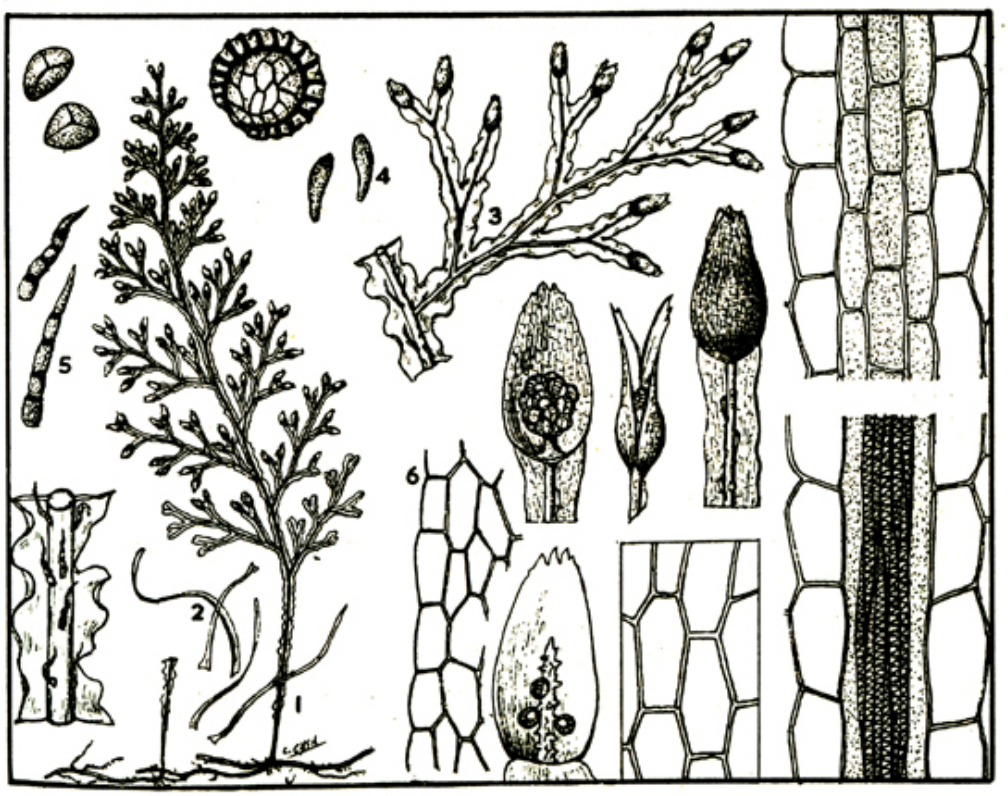

Plate 10. H. javanicum Sprengel. Taitung Co: Mt. Ramaramani, *Kao 7502*.

Rhizome creeping, glabrescent, rooting at intervals; stipes about 1 cm apart, about 3 cm long, winged nearly to base, wing margin somewhat crisped; fronds small, lanceolate, bipinnatifid, up to 10 or 12 cm long (including stipe); lower pinnae shortened; ultimate segments linear, about 1 mm wide, obtuse or notched at apex, margins flat or somewhat wavy; rachis wing nearly flat towards apex, becoming crisped towards base; sori abundant, borne on ends of ultimate segments; indusia cleft nearly to base, ovate, margins entire or slightly toothed at apex, receptacle cylindrical, included; sporangia sessile, not borne to base of receptacle, i.e. the basal part of the receptacle without sporangia.

Cellular structure: Laminar cells oblong; cell walls thin, straight; marginal cells with radial walls at nearly right angles to margin; veins made up of short spiral tracheids, surrounded by long thin walled cells; scattered unicellar clavate hairs, and multicellular linear pointed hairs borne along the margin of veins.

Chromosome number: Reported by Manton and Sledge as 2n=72. (1954:144)

Distribution: Ceylon, Indonesia, Malaya, Taiwan, Fiji, Australia.

Taiwan:

Taitung Co., Mt. Ramaramani, *Kao 7502*.

Note: This fern has rarely been found on Taiwan and is much like *M. crispato-alatum* but differs in the shape of its indusia and receptacle. This fern has ovate or lanceolate indusia and a cylindrical receptacle.

Ryukyu Species:

Hymenophyllum riukiuense Christ has not been reported from Taiwan as far as I know, but is occasionally collected in the Ryukyu's. It is similar to *H. javanicum* and *H. fimbriatum*. The lips of its indusia being more incised than *H. javanicum* and less so than in *H. fimbriatum*.

H. riukiuense Christ, in Ann. Cons. Jard. Bot. Geneve 4:208 (1900). Christ, 1901:1020; Nakai, 1926:244; Copeland, 1937:123, pl. 61.

H. liukiuense Christ, 1901:1021.

Mecodium riukiuense (Christ) Copel.

Copeland, 1938:21; H. Ito 1949:123; Tagawa, 1963:42 fig.

13. H. productum Kunze 南洋蕗蕨

Kunze, 1848:305; van den Bosch, 1861:56 pl. 45; Copeland, 1937:113 pl. 54. Holttum, 1954:83, fig. 26.

Mecodium productum (Kunze) Copel.

Copeland, 1938:20; 1958:51; Tagawa, 1940:140.

Stipes 4 to 6 cm long, winged in upper half, wing flat, entire; lamina 10 to 18 cm long, lanceolate, tripinnatifid, rachis winged, margins entire; sori sunken in leaf tissue at base; indusia ovate, cleft to base or nearly so, minutely toothed at apex, receptacle cylindrical.

Distribution: Malaya, Java, Sumatra, Borneo, Philippines, Taiwan.

Taiwan:

No specimens seen. Reported by Tagawa from Taitung Co., Kwang-shan, near Kakayo, *Tagawa 3144.*

14. H. oligosorum Makino 長毛蕗蕨 **Plate 11**

Makino, 1899:44; Nakai, 1911:385; 1926:247; Ogata, 1931: **4**: pl. 182.

Mecodium oligosorum (Mak.) H. Ito

Ito, H., 1949:122, Ohwi, 1957:25; 1965:34; Tagawa, 1963:42.

Rhizome filiform, creeping, becoming glabrescent, rooting at intervals apex of rhizome covered with long yellowish-brown appressed hairs; roots abundant, covered with brown multicellular hairs, stipes short, about 1 to 2 cm apart, 5–10 mm long wingless except at base of lamina; fronds ovate to lanceolate, 1 to 5 cm long, bi to tripinnatifid, lowest pinnae usually shortened; rachis winged to base; wings flat, entire; underside of fronds bearing persistent, long, yellowish-brown hairs along stipe, rachis, and veins (Figs. 6, 10, 13); sori borne on the upper lateral pinnae; indusia cleft to base, ovate or rounded, apex of lips slightly toothed, sides entire; receptacle included, cylindrical.

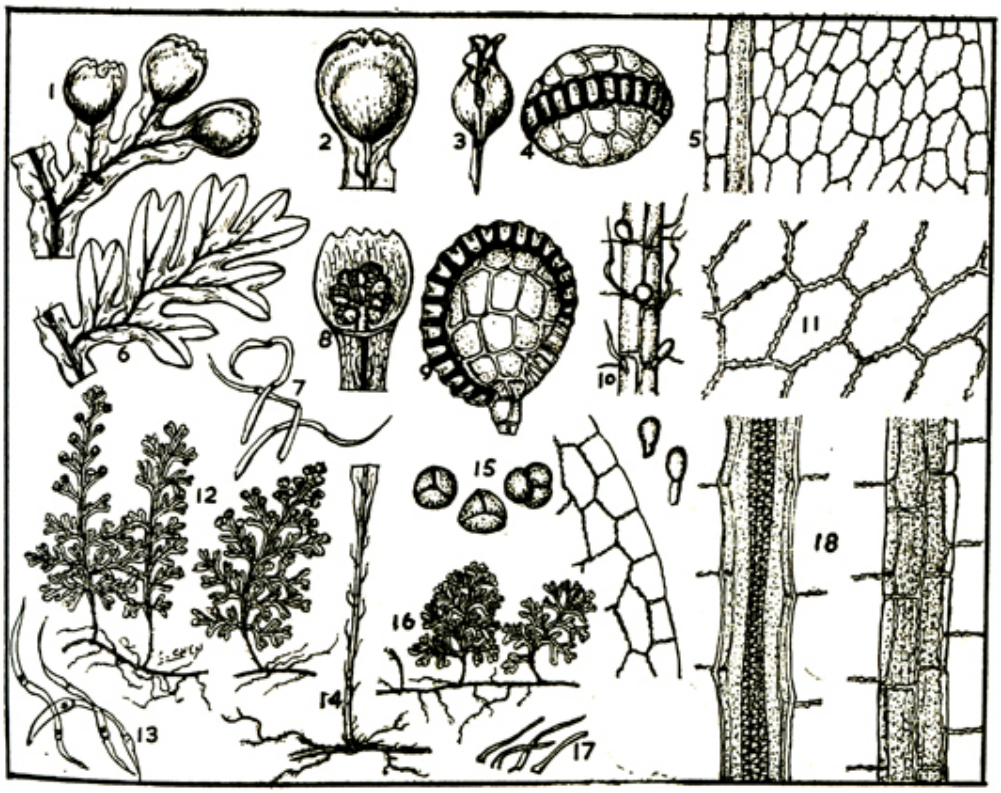

Plate 11. H. oligosorum Makino. Taitung Co: Chang-yen, *T. Suzuki 19740.*

Cellular structure: Laminar cells usually rectangular, longer than wide, but often irregular in shape; cell walls thin, wavy (Fig. 11); veins with spiral tracheids in center surrounded by elongated cells with thickened walls.

Chromosome number: Reported by Tatuno and Takei as 2n=42 (1969:126).

Distribution: Japan, Taiwan, Korea.

Taiwan:

Taipei Co., Lo-han-shan, *Simozawa* s.n. XI. 4. 1934; Ruggahu, *T. Suzuki 17580*; Agyoku, *T. Suzuki 14760*; Kyudaiensyurm, S. Sasaki s.n. XI. 3. 1932.
Taitung Co., Chang-yen, *T. Suzuki 19740.*
Hualien Co., without specific locality *Nakamura 5222.*
Hsinchu Co.. Yabakan, *T. Suzuki 20784.*

Note: Copeland considered *H. oligosorum* a synonym of *H. wrightii* (v.d. B.) Copel. (Copeland 1937:152–153). The chromosome number of *H. oligosorum* as determined by Tatuno and Takai is 2n=42 while of *H. wrightii* is 2n=84. The stipe, rachis and the veins are covered with persistent hairs on *H. oligosorum* while there are no hairs on the veins or rachis of *H. wrightii* and no hairs on the stipe except at its base.

15. H. wrightii v.d. B. 萊氏蕗蕨 **Plate 12**

van den Bosch, 1859:51; Franchet and Savatier, 1879:617; Makino, 1899: pl. 17; Matsumura, 1904:310; Takeda, 1910:179; Nakai, 1914:66; 1926:247; Komarov, 1934:18; Ogata, 1935, **6:** pl. 277; Copeland, 1937:152–153 pl. 82; DeVol, 1945:46; Iwatsuki, 1961:141–144; Bovin, 1966:263.

Mecodium wrightii (v.d. B.) Copel.

Copeland, 1938:23; H. Ito, 1944: pl. 459, 1949:122; Ohwi, 1957:26; 1965:34; Tagawa, 1963:42.

A dwarf fern of the *H. polyanthos* type (Copeland, 1937:152). Rhizome filiform, becoming glabrescent, hairs at base of stipe brownish, multicellular (Fig. 3.); fronds (including stipe) usually 1.5 to about 3.5 cm tall, sometimes up to 5 cm, deltoid-ovate to lanceolate, bi-to tripinnatifid; rachis winged to base; wing flat, narrow, entire; stipes narrowly winged at base of lamina, terete below (Fig. 4.); lamina and veins glabrous, without microscopic clavate hairs; ultimate segments entire, apices usually notched; sori sessile, indusia rounded, cleft to base, margins entire; receptacle included; sporangia globose sessile, not borne on base of receptacle (Fig. 6.).

Cellular structure: Laminar cells nearly isodiametric, walls straight, thin; hairs on roots linear, unicellular (Fig. 2.); hairs on rhizome at base of stipe linear, multicellular (Fig. 3.); microscopic clavate hairs have not been observed on the veins.

Chromosome number: Reported by Tatuno and Takei as 2n=84 (1969:126) and reported by Mitui as $n=27$ (1967:105).

Distribution: Mainland China, Taiwan, Japan (Hokkaido), Korea, Siberia and Canada (British Columbia).

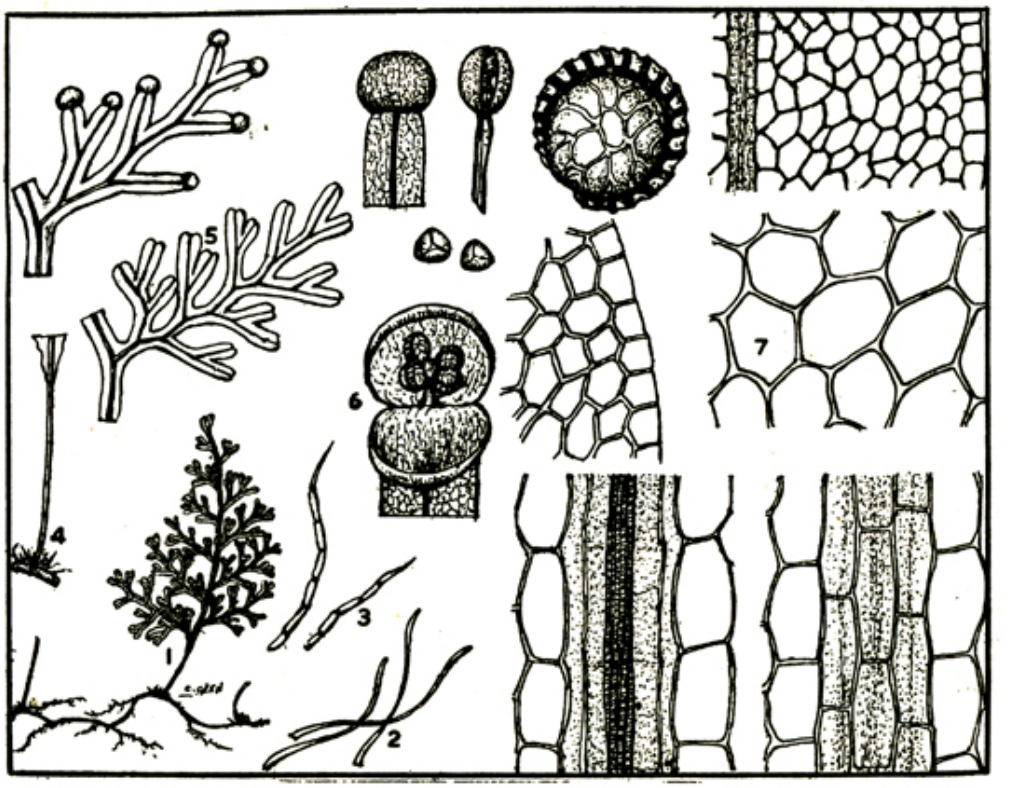

Plate 12. **H. wrightii** v.d. B. Kaohsiung Co: Hsin-wan-lin *T. Suzuki 20876.*

Taiwan:

Hsinchu Co., Maribarai, *T. Suzuki 20219.*
Chiayi Co., Hsin-kao-shan (Mt. Morrison) *Masamune 3828.*
Kaohsiung Co., Hsin-wan-lin, *T. Suzuki 20876.*
Hualien Co., Ching-shui-shan, *Nakamura 5441.*

Note: This small fern probably grows farther north than any other Asiatic species of Hymenophyllum. Taiwan is likely its southern limit.

16. H. polyanthos Sw. 細葉蕗蕨 **Plate 13**

Swartz, 1800:102; Hooker, 1844 (**1**): 106; Hooker and Baker, 1868:60; Hayata, 1914 (**4**): 142; T. Ito, 1928: pl. 388; Copeland, 1937:97 pl. 46, 47; DeVol, 1945:46.

Mecodium polyanthos (Sw.) Copel.

Copeland, 1938:19; 1958:49; H. Ito 1944: pl. 460; 1949:122; Ohwi, 1957:26; 1965: 34; Iwatsuki, 1958:65; Tagawa, 1963:42, 231; pl. 11 fig. 61.

H. blumeanum Spr.

Sprengel, 1827, **4**: 131; van den Bosch, 1861:46 pl. 36; Rosenburgh, 1908:71; Nakai, 1926:248.

H. ***integrum*** v.d. B.

van den Bosch, 1861:49 pl. 38; Nakai, 1926:248.

H. pycnocarpum v.d. B.

van den Bosch, 1861:48 pl. 37; Ogata, 1928, **1**: pl. 31.

H. paniculiflorum Presl

van den Bosch, 1861:49 pl. 39; sensu Nakai, 1926:246; Ohwi 1965:34

H. parallelocarpum Hay.

Hayata, 1914 (**4**): 141. fig. 82.

H. hayatai Masamune

Masamune 1936:2.

H. constrictum Hay.

Hayata, 1914(**4**):140 fig. 80; Sasaki, 1928:2.

H. fujisanense Nakai, 1926:249.

Rhizome widely creeping, glabrescent, rooting at intervals; stipes brown, distant, not winged or very narrowly winged above, usually 4 to 10 cm long; fronds very variable, up to 20 cm tall or more; lamina bi-to tripinnatifid, narrowly lanceolate to broadly ovate; rachis and rachillae narrowly winged throughout, wing entire, flat; sori terminal on ultimate segments of lateral pinnae; indusia broader than segments, ovate or rounded, margins entire, cleft to base; receptacle included.

Cellular structure: Cells of lamina polygonal, nearly isodiametric; walls thin, straight; the single row of marginal cells with walls at nearly right angles to the margin.

Chromosome number: Reported by Tatuno and Takei as 2n=56 (1969:12) and reported by Manton and Sledge as n=28 (1954:127) and by Mehra and Singh as n=27 (1957:379).

Distribution: Indonesia, Philippines, Vietnam, Malaya, Burma, India. Mainland China, Taiwan, Okinawa, Japan, Pacific Islands.

Taiwan:

Taipei Co., Ying Ko, *Simozawa Z3*; Sendan-yama, *T. Suzuki 7430*; Wulai (Urai) *S. Suzuki* XI-9-1928; Rimagan, *T. Suzuki 16528*; Kankou *S. Sasaki* s.n. XI. 10. 1932.

Taoyuan Co., Tamazan, *T. Suzuki 18206.*

Hsinchu Co.. Chia-li-tsien-shan *S. Sasaki 47.* Mt. Izawa-yama, *S. Sasaki* s.n. VII. 18. 1932.

Taichung Co., Pa-hsien-shan, *S. Sasaki 49, T. I. Chuang 2724, C.C. Kuo 647*; Ta-hsueh-shan, *Kao 190*; Tung-shih, *Simozawa Z4.*

Nantou Co., Ba-tun-kwang, *Kawakami 65*; Lo-lo, *Kawakami 66*; Chitou, *Kao 7513*; Hsin kang, *Yamanoto 1355*; Yun-hai, *Shieh 372*; Lan-ta-shan, *Shieh* s.n. IX-12-1967.

Chiayi Co., Alishan (Arisan) *B. Hayata 50* Type of *H. paralleocarpum* Hay. *Shieh 235, Kao 6781*; *J. M. Chao 131*; *DeVol 3348*; *Huang 1740*; *Hsu* and *Kuo 7450*; Mt. Nitaka, *S. Sasaki* s.n. XII. 3. 1933; *B. Hayata 23*; *T. Suzuki 17971*; Fun-chi-hu, *B. Hayata 63.*

Kaohsiung Co., Kuarus, *E. Matuda 16*; Buizan, *E. Matuda 198*; Nan-mien-shan, *T. Suzuki 20956.*

Pingtung Co., Hengchuan, *Kudo 1309*; Mt. Bui, *E. Matsuda 56.*

Taitung Co., Mt. Lamalamani, *Kao 6052*; Tawu (Diabu) *S. Suzuki 6905*; Hsinkang, *T. Suzuki 19629*; Tsing-shui-yin, *S. Sasaki* III. 21. 1932; *Masamnne 142*; Taitung Range, *Yamanoto* s.n. IV. 1. 1930.

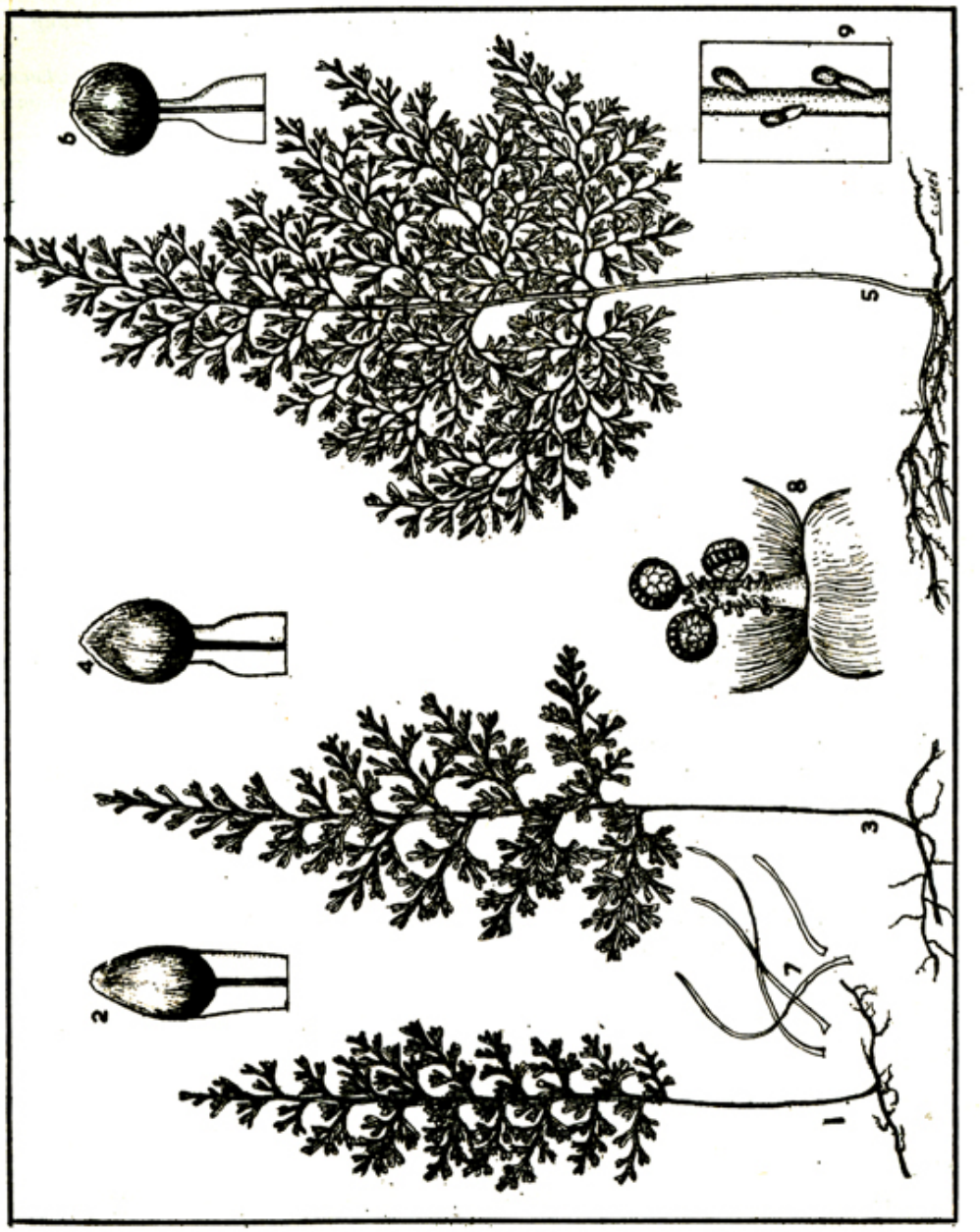

Plate 13. H. polyanthos Sw.

Fig. 1, 2. *H. blumeanum* Spr. Nantou Co: Chitou, *Kao 7513.*
Fig. 3, 4. *H. integrum* v.d. B. Ilan Co: Tai-ping-shan, *C. C. Chuang* and *Kao 4123.*
Fig. 5, 6. *H. constrictum* Hay. Chiayi Co: Mt. Ali, *S. Sasaki* Dec. 3, 1933.

Hualien Co., Mu-kua-shan, *Nakamura 4372*; Tsing-shiu-shan, *Nakamura 5418*; Taroko-taizan, *T. Suruki 10930*; Taroko, *S. Sasaki* s.n. VI. 7. 1933; Lintien-shan, *Feung 2*; Nan-kao-yeh, *Shieh 1006*.

Ilan Co., Nan-hu-ta-shan *S. Sasaki 48*; Mt. Bonbon, *Kao 5932*; Mt. Taiping, *C.C. Chuang 4123*; *Kao 6800*; Ta-pa-tzien-shan. *S. Sasaki* s.n. VII. 7. 1932; *S. Suzuki 565*, Pianan, *Masamune* s.n. VII. 4. 1930.

Note: This very variable fern has been given many names. If only the extreme forms were examined they would be considered distinct species. Our artist, Mr. Chen has drawn three of the rather distinct varieties on **Plate 13** so that their similarities and differences can be easily observed.

In each some characters **are similar:**

1. The stipe is wingless. (Figs. 1, 3, 5.)
2. The linear hairs on the roots are unicellular. (Fig. 7.)
3. The microscopic clavate hairs along the rachis are the same. (Fig. 9.)
4. The receptacle is cylindrical. (Fig. 8.)
5. The sporangia are nearly round and are not borne on the base of the receptacle.

The three varieties **differ** as follows:

Fig. 1, 2. H. blumeanum Spr.

(*H. parallelocarpum* Hay.)

Fronds very narrow, lower pinnae usually shortened; indusia ovate, sunken in leaf tissue.

Fig. 3, 4. H. integrum v.d. B.

(*H. pycnocarpum* v.d. B.)

(*H. fujisanense* Nakai)

Fronds narrowly deltoid, lowest pair of pinnae slightly larger than the pair above; indusia oval, sessile; the leaf apex slightly narrowed below the indusia.

Fig. 5, 6. H. polyanthos Sw.

(*H. paniculiflorum* Presl)

(*H. constrictum* Hay.)

Fronds broadly ovate, lowest pinnae much enlarged; indusia rounded; leaf apex much constricted below the indusia.

But there is so much variation in between these three types that I do not think it adviseable to even recognize them as varieties. This problem and many others need continued study.

The accompanying chart shows up many of the similarities and differences in our Taiwan species of Hymenophyllum.

	H. barbatum	*H. simansicanum*	*H. blandum*	*H. acanthoides*	*H. denticulatum*	*H. holochilum*	*H. taiwaniese*	*H. alishanense*	*H. badium*	*H. crispato-alatum*	*H. fimbriatum*	*H. javanicum*	*H. productum*	*H. oligosorum*	*H. wrightii*	*H. polyanthos*
pinnae margin dentate	+	+	+	+	+	+	+	+								
pinnae margins entire									+	+	+	+	+	+	+	+
receptacle protruding			+	+	+	+	+									
receptacle included	+	+						+	+	+	+	+	+	+	+	+
rachis winged	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
rachis wingless			+													
rachis wing flat						+		+							+	+
rachis wing wavy	+	+							+		+	+		+		
rachis wing crisped				+	+					+	+					
indusia entire					+	+			+	+		+			+	+
indusia slightly toothed									+	+		+		+		
indusia incised	+	+	+					+			+					
spines on back of indusia				+	+											
receptacle cylindrical	+	+	+	+	+	+		+			+	+		+	+	+
receptacle capitate									+	+						
multicellular hairs on rachis and veins	+	+			+	+				+				+	+	
microscopic clavate hairs on veins	+	+	+		+	+		+	+	+	+	+		+	—	+
cell walls straight	+	+	+			+			+	+	+	+			+	+
cell walls wavy	+			+	+			+						+		
stipe wingless or nearly so			+					+						+	+	+
stipe winged, at least upper half	+	+			+				+	+	+	+				
sporangia borne on base of receptacle	+	+	+		+	+										
sporangia not borne on base of receptacle								+	+	+	+	+		+	+	+

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INDEX

(Synonyms in italics.)

Didymoglossum
acanthoides v. d. B. 278
holochilum v. d. B. 281
Hymenophyllum
acanthoides (v. d. B.) Rosenst. 278
alishanense DeVol 283
australe non Willd. 289
badium Hook. et Grev. 284
barbatum v. d. B. 276
blandum Racib. 279
blumeanum Spr. 293
ccnstrictum Hay. 294
crispato-alatum Hay. 286
denticulatum Sw. 280
fimbriatum J. Sm. 288
flexile Mak. 284
fujisanense Nakai 294
hayatai Masa. 294
holochilum (v. d. B.) C. Chr. 281
integrum v. d. B. 293
japonicum Miq. 276
javanicum Springel 289
javanicum sensu Hay. 286
jvnghuhnii sensu Ogata 286
liukiuense Christ 290
micranthum v. d. B. 289
okadai Masa. 278
oligosorum Mak. 291
omalopterum Hay. 286
paniculiflorum Presl 294
parallelocarpum Hay. 294
polyanthos Sw. 293
productum Kunze 290
pycnocarpum v. d. B. 294
retusilobum Hay. 286
riukiuense Christ 290
simonsianum Hook. 277
taiwanense (Tagawa) Morton 284
wrightii v. d. B. 292
Leptocionium
acanthoides v. d. B. 278
barbatum v. d. B. 276
denticulatum v. d. B. 280
Mecodium
badium (Hook. et Grev.) Copel. 284
crispato-alatum (Hay.) Copel. 286
fimbriatum (J. Sm.) Copel. 288
javanicum (Spr.) Copel. 289
oligosorum (Mak.) H. Ito 291
polyanthos (Sw.) Copel. 293
productum (Kunze) Copel. 290
riukiuense (Christ) Copel. 290
taiwanense Tagawa 284
wrightii (v. d. B.) Copel. 292
Meringium
acanthoides (v. d. B.) Copel. 278
blandum (Racib.) Copel. 279
denticulatum (Sw.) Copel. 280
holochilum (v. d. B.) Copel. 281